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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Influence of solar forcing, climate variability and atmospheric circulation patterns on summer floods in Switzerland" *by* J. C. Pe na et al.

Anonymous Referee #1

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General comments: It is a lively discussed fact that floods occur in clusters which are separated by longer breaks of several decades. Based on a combined index of summer flood damage in Switzerland between 1800 and 2009 the authors study the connections between the floods, solar cycles, temperature and atmospheric circulation. They found four distinct periods with floods. In their analysis the authors use well-known and proven statistical methods. The paper is rather long. It is written in a comprehensible style, but there are still some open questions to be considered by the authors.

Specific comments: 1) The first concerns the flood data set. It is a real merit to combine

a precise flood database with flood damage data. Unfortunately the division of the research area into five administrative regions, even it was carried out with suitable statistical methods, hinders a more precise dynamic interpretation. Would it not be an advantage to distinguish precisely between the northern and southern slopes of the Alps? 2) Unfortunately the authors have not considered three recent papers providing important aspects of alpine flooding: Stucki, P. et al., 2012, Meteorol. Zeitschr. 21/6, p. 531 / Glur et al., 2013, Nature Scientific Reports, Article nr. 2770 (26.9.2013) / Wirth, S.B. et al. , 2013, Geophys. Res. Lett. 40, doi :10.1002/grl.50741). The finding of the authors partly differ from those in these papers, and that not only related to the defined flood periods. The aforementioned papers agree with the authors of this paper that summer floods are strongly connected to cool summers, except for the two periods 1977-1990 and 2005 to present. But in their paper the authors also state that "the river catchments in the centre and southern flank of the Alps are affected by atmospherically unstable areas defined by a positive SNAO". This is in contradiction with Wirth et al. (2013) who show that a low TSI (a so-called Grand Solar Minimum GSM) is attributed to a southerly position of the westerlies and positive precipitation anomalies in the NW Med. area. The same fact is also confirmed by the fundamental papers of Folland et al. (J. Climate 22 / 2009, p. 1082ff.) and Bladé et al. (Clim. Dyn. 2011, DOI 10.1007/s00382-011-1195-x). 3) The paper lacks of a clear mechanistic explanation, even this is a difficult task. The key question is whether the floods are really correlated with solar activity, temperature and SNAO. Based on Figure 9 this conclusion is at least justifiable for solar activity and temperature. Indeed periods with low solar activity, in many cases connected to a negative SNAO, often covary with volcanic events (e.g. during Dalton Minimum). Therefore, it is not absolutely clear whether the correlation with solar activity is real or not. I am also asking myself whether the SNAO is the best mode to define circulation changes because the Alps are situated in the transition area between the northern and the southern pole of this pattern (also mentioned by the authors). Another aspect concerns the area you defined for your PCA analysis. Was it not rather small? I have the impression it would possibly be better to

correlate the flood frequencies with the Atlantic Multidecadal Oscillation (AMO) which is a rough representation of the triggering SSTs in the North Atlantic area. 4) Finally, I recommend, for the conclusions, to answer the questions: What was known before? What is new (e.g. was it possible to explain the remarkable flooding gap in the 20th century?).

Formal aspects: 1) The font size in some figures is quite small. 2) I do not understand the different expressions on the y-axis of the figures 4 a and 4 b with almost the same curves (maybe a statistician would!).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 13843, 2014.